said layer is (1) a material selected from the group consisting of silicon oxide, silicon nitride, and a polymer having a low dielectric constant, or (2) one layer of silicon oxide and another layer of silicon nitride, and

said abrasive liquid composition comprises an aqueous acid suspension of

(i) individualized colloidal silica particles not linked to each other by siloxane bonds,

together with (ii) a surfactant.

Dend

REMARKS

The final Action of July 5, 2001, and the references applied therein, including the newly cited reference, has been carefully studied. The claims in the application remain as claims 17-36. Applicants respectfully submit that these claims define novel and unobvious subject matter under Section 102 and 103 over any known prior art, and therefore applicants' claims should be allowed. Accordingly, applicants respectfully request favorable reconsideration, entry of the amendment presented above and allowance.

The amendment presented above in claim 1 is made to emphasize that the present invention uses a **liquid** composition containing an abrasive, generally called a slurry. The slurry is poured on a rotating pad as noted for example on page 9,

line 9, and in Example 1 which shows an abrasive flow rate of 100 cm^3/min. Of course, this subject matter was already in claim 17 (and even in claim 1 as originally submitted) by recitation that the abrasive composition "comprises an aqueous acid suspension".

Claims 17-36 have been rejected as obvious under Section 103 from Jacquinot '159 (previously applied), Robinson (previously applied), and Bruxvoort et al USP '794, newly cited and applied (Bruxvoort). This rejection is respectfully traversed.

As previously acknowledged, Jacquinot '159 is clearly the closest prior art, as it relates to a process similar to that of the present invention, but wherein the abrasive composition contains no surfactant. **There is no doubt whatsoever that addition of a surfactant according to the present invention produces surprisingly improved results, i.e. non-obvious subject matter.** There is nothing in the subsidiary references which would have led one to reasonably expect that the addition of a surfactant to the liquid composition of Jacquinot '159 would produce improved results.

Thus, in the present invention, the use of a surfactant in the aqueous acid suspension allows the polishing speed of the silicon nitride to be reduced very considerably while preserving the polishing speed of the silicon oxide. In

this regard, applicants' specification states as follows at page 7, lines 7-11:

> The surfactant used allows the polishing speed of the silicon nitride to be reduced very considerably whilst preserving the polishing speed of the silicon oxide. A selective polishing of the silicon oxide relative to the silicon nitride is thus obtained. It also allows the polishing speed of polymers with a low dielectric constant to be increased very considerably.

A selective polishing of the silicon oxide related to the silicon nitride is thus obtained (please also see example 1, test 4; example 2, test 9; example 11, test 3; and example 13 test 4). As stated above, the use of the surfactant further allows the polishing speed of polymers with a low dielectric constant to be increased very considerably (please also note example 5 of the present specification).

Accordingly, it surprisingly turns out that the presence of a surfactant as part of the liquid polishing composition very substantially increases the polishing performance, a result which could not have been reasonably expected from a consideration of the cited prior art, and certainly not a result which could have been predicted or foreseen. With great respect, if the examiner disagrees, applicants would like the examiner to point out where in the references there is any suggestion, any teaching, or even the remotest inference that adding a surfactant to a liquid

polishing composition would improve the results as are achieved according to the present invention.

Robinson is directed to a polishing pad containing voids and optional abrasive particles 18 incorporated within the pad. Please note that the pad is a **solid** pad. Such a pad has a thickness of about ten to about a hundred mils, and is molded from composite or elastomeric substances (see the bottom of column 4). Various polishing techniques are mentioned, but there is no teaching that a liquid abrasive is equivalent to a solid abrasive (and they are not equivalent). Applicants see nothing in Robinson which even mentions the possibility of adding a surfactant to a polishing slurry, let alone that any such expedient could produce an improved result. The relevance of Robinson to the present invention is unclear to applicants, and is believed to be tenuous at best.

Bruxvoort, newly cited, takes the place of Chen, previously cited and now dropped. Like Robinson, Bruxvoort relates to a solid abrasive, e.g. something in the nature of very fine sandpaper.

As mentioned at about the middle of column 1, a first aspect of Bruxvoort involves a method of contacting the surface of a semi-conductor wafer with a three-dimensional, textured, fixed abrasive article that includes a plurality of abrasive particles and a binder in the form of a pre-

determined pattern, and moving the wafer and the fixed abrasive article relative to one another to modify the surface of the wafer. This operation may be carried out in the presence of a liquid which preferably water at a pH of at least 5 and preferably 5-8 or 8-13. In the second, third and fourth aspects of Bruxvoort (bottom half of column 3), the same steps are carried out, with the nature of the abrasive article being somewhat different in each case.

Surfactants are mentioned in the paragraphs spanning columns 20 and 21, but these surfactants are used in the manufacture of the pad, i.e. in providing the abrasive coating on the pad, and have nothing to do with the liquid medium fed between the pad and the surface to be worked as shown in Fig. 3. Thus, abrasive particles may be mixed with an additive such as a surfactant for improving the dispersability of the abrasive particles in the binder precursor and/or the binder, because of their wetting properties (e.g. column 20, lines 35 *et seq)*. In the course of preparing the pad, the abrasive slurry is transformed into the abrasive coating adhered to the pad, and curing takes place using ultra-violet radiation to provide a solid article. The optional surfactant in this regard is only used for preparing the cured article. See for example Figs. 16 and 17 and the text at the bottom of column 2.

The rejection focuses on the surfactant added to the fixed abrasive pad to modify the surface of the abrasive particles. Applicants submit with respect that such a teaching is irrelevant, and that such addition of a surfactant in the manufacture of the abrasive coated pad is non-analogous to the present invention and teaches the person of ordinary skill in the art nothing with respect to the present invention.

As noted above, Fig. 3 of Bruxvoort discloses the feeding of the liquid medium to the interface between the semi-conductor wafer and the abrasive coated pad. A basket or shotgun disclosure of liquid media which may be used is set forth at column 12, lines 45-56. There follows further basket or shotgun disclosures of additives which may be present including chemical etchants (paragraph spanning columns 12 and 13), oxidizing agents (column 13, line 4), "surfactants, wetting agents, buffers, rust inhibitors, lubricants, soaps, and the like" (column 13, lines 14-15). A long listing of lubricants is given (column 13, lines 24-30), but applicants find no disclosure of any particular or particular types of surfactants or wetting agents to be added to the liquid to be fed between the pad and the work piece.

The working examples provide no additional information which would lead the person of ordinary skill in

the art to the present invention. In Test Procedure I, noting especially column 53 commencing at line 26, it will be seen that the liquid used was a potassium hydroxide solution in de-ionized water with a pH of about 11.5-12.5. Test Procedures II and III were the same in this regard. Test Procedure IV apparently used tap water (column 54, line 12). Test Procedure V used deionized water and a seria sol.

Test Procedures VI-XVII reverted to the use of the same or similar potassium hydroxide solutions. Test Procedure XVIII added an abrasive slurry to the potassium hydroxide solution. The remaining test procedures reverted to the potassium hydroxide solution.

Examples 1-25 relate to the manufacture of the abrasive coated pad. Examples 26 and 27 were tested according to Test Procedure 1, Example 28 according to Test Procedure III, Examples 29 and 30 according to Test Procedure IV, Examples 31 according to Test Procedure VI, Examples 32 and 33 according to Test Procedure IV, etc. Not a single one of the 147 examples of Bruxvoort shows the use of a surfactant in the liquid medium fed to the interface between the work piece and the abrasive coated pad.

One question then is what does Bruxvoort fairly teach the person of ordinary skill in the art, i.e. what is the motivation or incentive it provides. Stated another way,

where does the reference lead the person of ordinary skill in the art (*Ex parte Levengood*, 28 USPQ2d 1300; *In re Zurko*, 42 USPQ2d 1476). The examples of Bruxvoort do indeed provide concrete teachings or "leadings", but not toward applicants' invention. The general basket or shotgun disclosure of Bruxvoort is so immense that it leads the person of ordinary skill in the art in no particular direction, but at best in all possible directions. In this regard, attention is invited to *Ex parte Garvey*, 41 USPQ 583 (1939) in which the Board stated:

> The likelihood of producing a composition such as here claimed from a disclosure such as shown by the Dykstra patent would be about the same as the likelihood of discovering the combination of a safe from a mere inspection of the dials thereof.
>
> * * *
>
> ..., as in the Dykstra et al disclosure, the proper one of large number of possible permutations must be chosen to bring the disclosure within the terms of the claims on appeal. Under such circumstances, we do not feel that the patent is a fair reference.

The same idea was expressed in *Laitram Corp. v. Cambridge Wire Cloth*, 226 USPQ 289, 293 (1985) where it was stated:

> To illustrate this notion, you cannot claim that the existence of a unicorn should be obvious from taking a trip to the zoo and seeing a horse and a white rhinoceros in adjacent cages. It takes a spark of inventiveness to look at a horse and then

> look at a white rhinoceros and then conceive the idea of a white horse with a horn.

The point applicants wish to emphasize in this regard is that the options mentioned in Bruxvoort are so numerous as to encompass practically every possibility, except with regard to the abrasive coated pad. Bruxvoort does not really provide any guidance that one should follow any other particular expedient. The only real guidance, other than in the selection of the abrasive coated pad (although even this point is given rather broadly), is in the examples, and the examples do not lead the skilled artisan toward the case of a surfactant in the liquid medium. To the contrary, the examples given in Bruxvoort are markedly different and lead the person of ordinary skill in the art **away** from applicants' invention.

However, even if the PTO were to maintain its position that Bruxvoort suggests to one skilled in the art that a surfactant may be added to the liquid composition of Jacquinot '159, this **still** does not reach the present invention, because that does not take into account applicants' invention "as a whole", namely applicants' invention including the unobviously improved results achieved.

In this regard, the prior art provides no reasonable expectation of the improved polishing achieved according to

the present invention and shown in applicants' examples. For example, as disclosed in comparative example 1, with a similar composition of pH 7, poor results were achieved. Also please again consider the comparative results set forth in examples 2, 11 and 13 as pointed out above.

Applicants again respectfully request favorable reconsideration and allowance.

Respectfully submitted,

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"**Version with Markings to Show Changes Made**"

17. (Amended) A process for mechanical chemical polishing in the integrated circuits industry, comprising

rubbing a layer with a support impregnated with an abrasive liquid composition, wherein

said layer is (1) a material selected from the group consisting of silicon oxide, silicon nitride, and a polymer having a low dielectric constant, or (2) one layer of silicon oxide and another layer of silicon nitride, and

said abrasive liquid composition comprises an aqueous acid suspension of

(i) individualized colloidal silica particles not linked to each other by siloxane bonds,

together with (ii) a surfactant.